REMARKS

Claims 1-20 are all the claims pending in the application. Claims 1-20 stand rejected on prior art grounds. Applicants respectfully traverse these rejections based on the following discussion.

I. The Prior Art Rejections

Claims 1-3, 5, 7-10, 12, 14-17, and 19 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Yasukawa (6,344,888) in view of Omori et al., hereinafter "Omori" (4,972,250) and Howe (4,640,744). Claims 4, 11, and 18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Yasukawa, Omori and Howe, further in view of Hanihara et al., hereinafter "Hanihara" (5,990,988). Claims 6, 13, and 20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Yasukawa, Omori and Howe, in further view of Admitted Prior Art (APA). Applicants respectfully traverse these rejections based on the following discussion.

A. The Rejection Based on Yasukawa, Omori, and Howe

Before addressing the individual prior art rejections, Applicant's note that the Office Action fails to set forth a prima facia case of obviousness. Therefore, all rejections are defective and should be withdrawn. Generally, the fact that the references teach away from the claimed invention, the lack of any objective motivation to combine references, and the large number of references demonstrates that a prima facia case of obviousness has not been set forth.

The claimed invention is directed to a reflective-type liquid crystal display. Yasukawa discloses a reflective-type liquid crystal display, however Yasukawa teaches directly away from the invention by requiring an insulator be positioned as a passivating layer next to the electrodes, while the claimed invention utilizes an amorphous carbon-containing, slightly conductive layer be adjacent the liquid crystal material. In order to modify Yasukawa to include this carbon-containing layer in place of the insulator, the

rejection makes reference to Omori and Howe. Unfortunately, these references have nothing whatsoever to do with reflective-type liquid crystal displays. Omori is directed to passivating layers on semiconductor devices, such as bipolar and field effect transistors (col. 1, lines 13-26) and Howe is directed to electrochemical cells, such as energy generating photo electrochemical cells (col. 1, lines 7-11). It is unreasonable to suggest that the teachings from the these very different art fields could change the requirements in Yasukawa that an insulating layer be positioned next to the electrodes in a reflective-type liquid crystal display. Omori and Howe teach the use of carbon-containing layers and teach various ranges of resistivity and conductivity; however neither Omori nor Howe (nor any other prior art teaching) containing a suggestion that the teachings should be applied to reflective-type liquid crystal displays, much less that an amorphous carbon-containing layer having the claimed a level of conductivity (the carbon containing layer that "provides a level of conductivity corresponding to a resistivity between 10^4 and 10^{11} ohms-cm") should be substituted for the insulator disclosed in Yasukawa.

As described, for example, on page 21, lines 10-14 of the application, by using the amorphous carbon film to passivating the electrode 38 and the pixel electrode 32 of the reflective-type flickered crystal display, the Vcom shift is uniformly small across the display panel and stable over time under different operating conditions, which reduces the amount of flicker seen within the display. Because Yasukawa teaches that an insulator layer should be used in a position where the invention uses the amorphous carbon film, structures built according to the teachings of Yasukawa will suffer from a greater amount of flicker within the liquid crystal display.

The primary reference Yasukawa requires that an insulator (silicon oxide) be positioned as a passivating layer next to the electrodes. This teaches away from the claimed invention that defines a carbon-containing layer that "provides a level of conductivity corresponding to a resistivity between 10^4 and 10^{11} ohms-cm." Clearly, by requiring that an insulator be positioned adjacent the liquid crystal material, Yasukawa teaches directly away from the claimed invention which utilizes a slightly conducting layer adjacent the liquid crystal material.

Further, Yasukawa does not teach or suggest the use of a carbon-containing or diamond-like conductive film adjacent one or both of the electrodes in a reflective LCD

device, as in the claimed invention. To the contrary, Yasukawa requires that an insulator (silicon oxide) be positioned as a passivating layer next to the electrodes. Here, the claims clearly define a carbon-containing layer that "provides a level of conductivity corresponding to a resistivity between 10^4 and 10^{11} ohms-cm." Silicon dioxide is an insulator, unless modified (as with carbon) so that it changes its insulating characteristics. There is no teaching in the prior art of record of altering the silicon oxide insulator in Yasukawa to include carbon or in any other way to become a slightly conducting film. Yasukawa explicitly uses the silicon dioxide layer 17 as an insulator and calls the layer a "passivating layer." Yasukawa uses silicon oxide to prevent significant change in reflectance due to the variation of film thickness and wavelength of light.

Omori describes a passivating layer that is used to protect semiconductor devices against environmental influences (column 1, lines 14-26) and describes that the passivating material may be amorphous carbon, diamond-like carbon, etc. and that it may be used with semiconductor devices such as bipolar transistors and field effect transistors (column 4, lines 19-28). Omori only describes the amorphous carbon material as an insulator and does not described that the amorphous carbon material could have conductive properties as in the claimed invention. There is nothing within Omori that would suggest to one ordinarily skilled in the art that the passivating layer described in Omori should be used with reflective-type liquid crystal display devices, much less that passivating layer should be used in the location that is defined by the claims in order to reduce or eliminate flicker within liquid crystal displays (or for any other reason). Therefore, it is Applicants position that Omori would not have led one ordinarily skilled in the art to modify the requirements in Yasukawa that an insulating layer be positioned next to the electrodes in a reflective-type liquid crystal display.

Howe relates to electrochemical cells that utilize an electrolyte in contact with two or more cells, which can be utilized, for example, to generate energy from solar radiation (column 1, lines 66-column 2, line 9). Howe discloses that the resistivity of an amorphous carbon material can be controlled to be between 0.1 and 10^{11} ohms-cm. However, Howe does not contain any instruction or suggestion as to what the range of resistivity (conductivity) a passivating layer for a reflective type liquid crystal display should be. Howe does not even indicate that amorphous carbon materials should be

utilized with liquid crystal displays. More importantly, there is no teaching within Howe that would suggest to one ordinarily skilled in the art that the requirements in Yasukawa of an insulating layer next to the electrodes should be modified into a slightly conductive layer as in the claimed invention to produce any benefit, much less the benefit described above with respect to reducing flicker within the liquid crystal display.

In order to overcome the clear teachings of Yasukawa with respect to the use of an insulator layer next to the electrodes, to render the claimed invention obvious, it would be necessary for a teaching to explain that a different type of material should be used in place of the insulator within a liquid crystal display device. The prior art of record does not do this. Instead, the prior art of record merely describes general features of a passivating material (Omori) and of an amorphous carbon material (Howe). Omori and Howe described that their materials have many uses; however neither reference provides any suggestion of the using any form of conductive material in place of the insulator described in Yasukawa, or even that their materials should be used with liquid crystal displays in any manner. Such a teaching is mandatory for any proper prima facia case of obviousness, when the rejection seeks to modify direct teachings of a reference (Yasukawa). Such a teaching is not present in the prior art of record, and this deficiency renders the rejection defective.

In view of the foregoing, Applicants submit that the Examiner has engaged in impermissible hindsight reasoning in order to arrive at a conclusion of obviousness. Further, the Examiner has selected a reference which teaches away from the claimed invention (Yasukawa) and references which are not analogous to the claimed invention (Omori, Howe) in arriving at a conclusion of obviousness. Only one of the three applied references relates to the claimed subject matter of reflective-type liquid crystal displays (Yasukawa) and this reference teaches away from the claimed invention by requiring an insulator layer where the claimed invention uses a slightly conductive layer. The remaining references (Omori, Howe) are drawn from non-analogous art fields and do not contain any teaching which would motivate one skilled in the art to modify the clear teaching within Yasukawa.

Therefore, the proposed combination of references does not teach or suggest the invention of independent claims 1, 3, 8, 10, 15, or 17 that define the carbon containing

layer that "provides a level of conductivity corresponding to a resistivity between 10^4 and 10^{11} ohms-cm" and such claims are patentable. Further, dependent claims 2, 5, 7, 9, 12, 14, 16, and 19 are similarly patentable. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

B. The Rejection Based on Yasukawa, Omori, Howe, and Hanihara

Hanihara does not cure the deficiency of the combination of Yasukawa, Omori, and Howe, shown above. More specifically, Hanihara does not teach or suggest the carbon containing layer that "provides a level of conductivity corresponding to a resistivity between 10^4 and 10^{11} ohms-cm" as defined by independent claims 1, 8, and 15. Indeed, Hanihara is only referenced for showing that silicon oxide has a unidirectional orientation matched to the liquid crystal material and is not intended to teach or suggest a diamond-like conductive amorphous layer. Therefore, any combination of Hanihara and Yasukawa, Omori, and Howe would not teach or suggest the carbon containing layer that "provides a level of conductivity corresponding to a resistivity between 10^4 and 10^{11} ohms-cm" as defined by independent claims 1, 8, and 15. Therefore, independent claims 1, 8, and 15 are patentable over any combination of Yasukawa, Omori, Howe, and Hanihara. Further, dependent claims 4, 11, and 18 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. In view of the forgoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

C. The Rejection Based on Yasukawa, Omori, Howe, and APA(Lu)

Neither the APA nor the previously discussed Yasukawa, Omori, or Howe teach or suggest the carbon containing layer that "provides a level of conductivity corresponding to a resistivity between 10^4 and 10^{11} ohms-cm" as defined by independent claims 1, 8, and 15. The APA (Figure 1, page 2, line 18-page 3, line 10 of the specification) teaches that when a voltage below a threshold voltage is applied to the gate line 107, the transistor 109 is in an off condition so that the potential on the data bus line

108 and electrode 106 are isolated from one another. When a voltage larger than the threshold voltage is applied on the gate bus line 107, the transistor 109 is in an on condition (low impedance state), thereby allowing the voltage on the data bus line 108 to charge the electrode 106. Varying the voltage to the electrode 106 controls the liquid crystal cell 111 such that different amounts of light are transmitted across the liquid crystal display, thus resulting in the display of a gray scale of light. A reflective type AMLCD is similar in structure to the transmissive type AMLCD; however, the transparent electrode 106 is usually replaced with a reflective metal electrode which generally occupies a larger area to cover the transistor 109.

As shown above, the claimed invention is fundamentally different than any of the teachings in the prior art. The invention avoids flicker LCD problems by using a slightly conducting thin film, e.g., diamond like carbon (DLC) film, coated on both the Al and ITO electrodes of reflective LCDs to reduce and stabilize the Vcom shift. The slightly conducting film allows electrical charges to flow toward the electrodes and bend the Fermi level of the adjacent electrode and balance the surface potential. Thus, with the invention, the Vcom shift is small and stable so that the display can be operated in the frame inversion drive with a frame rate lower than 70 Hz without perceivable flicker. Such features are simply not taught or suggested by the prior art of record.

More specifically, none of the applied references teaches or suggests the carbon containing layer that "provides a level of conductivity corresponding to a resistivity between 10^4 and 10^{11} ohms-cm" as defined by independent claims 1, 8, and 15. Therefore, independent claims 1, 8, and 15 are patentable over any combination of Yasukawa, Omori, Howe, and the APA. Dependent claims 6, 13, and 20 define that the voltage between the first-type and reflective electrodes controls the transparency of the liquid crystal material. As shown above, Yasukawa is deficient in teaching that the carbon containing layer that "provides a level of conductivity corresponding to a resistivity between 10^4 and 10^{11} ohms-cm" as defined by independent claims 1, 8, and 15. Contrary to such slightly conductive layers, the prior art actually teaches a passivating layer. Therefore, Applicant's submit that the prior art of record does not teach or suggest using such a conductive amorphous layer to control the transparency of the liquid crystal material as defined by dependent claims 6, 13, and 20. Therefore, dependent claims 6,

13, and 20 are patentable over the prior art of record. The concept of using a slightly conducting amorphous layer to control the transparency of the liquid crystal material is a concept that is independently patentable. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

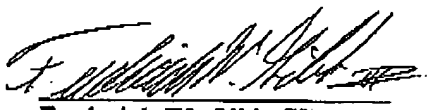
III. Formal Matters and Conclusion

In view of the foregoing, Applicants submit that claims 1-20, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary.

Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 50-0510.

Respectfully submitted,



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Date: 3-3-05

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